A study of the mechanical response of a Zr modified 2014 aluminium alloy

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Abstract

The present work illustrates the mechanical behaviour of a Zr stabilized Al-Cu alloy. The room temperature tensile and fatigue response of the material was studied, the fatigue test of the material has been carried out by using a fatigue test machine working at 250 Hz. The mechanisms governing fatigue life, cyclic deformation and fracture characteristics are studied as a function of the magnitude of the applied stress and intrinsic microstructural evolution. The curve representing the stress amplitude fatigue life response of the material in the Zr stabilised condition showed a classical behaviour with increasing fatigue life as cyclic stress decreases. A fatigue life of 10^7 cycles at 110 MPa was recorded. The warm forming plasticity conditions of a Zr modified 2014 aluminum alloy have been widely studied in the present work. Torsion tests were performed in the temperature and strain rate ranges of 250-300 °C and 10^{-3}-1 s^{-1} respectively. The ductility of the material subsequently to Zr addition was analyzed in terms of strain to fracture in torsion, and the constitutive equations and the activation energy in warm forming conditions were calculated. The microstructure in the as-received and deformed conditions was characterised by optical and electron microscopy techniques (TEM); the crack growth and propagation was determined by scanning electron microscopy observations (FEGSEM).

Keywords: 2014+Zr, Fatigue life, warm forming, FEGSEM, TEM.

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